Safely Adopting Remotely-Controlled and Autonomous Operations in Canada's Offshore

Dave Finn, PRNL
Vidar Hepsø, Equinor
Jonathan Power, NRC Canada
Oct 21, 2020

Outline

- Snapshot of Canada’s offshore
- Supporting the transition to remote operations
- HF safety research at Canada’s National Research Council

petroleum RESEARCH newfoundland & labrador

- Industry-led R&D facilitator active in Atlantic Canada for 20 years
- Canadian, federally-incorporated, not-for-profit organization
- Digital transformation is an industry priority
- Major investor in Canada’s Ocean Supercluster

Chevron

equinor

ExxonMobil

Husky Energy

SUNCOR ENERGY

Offshore Newfoundland

Orphan Basin

Flemish Pass

Hibernia

White Rose

Hebron

Terra Nova

FOUR PRODUCING FIELDS
2019 avg daily production = 260K bbls
2020 avg to date = 295K bbls

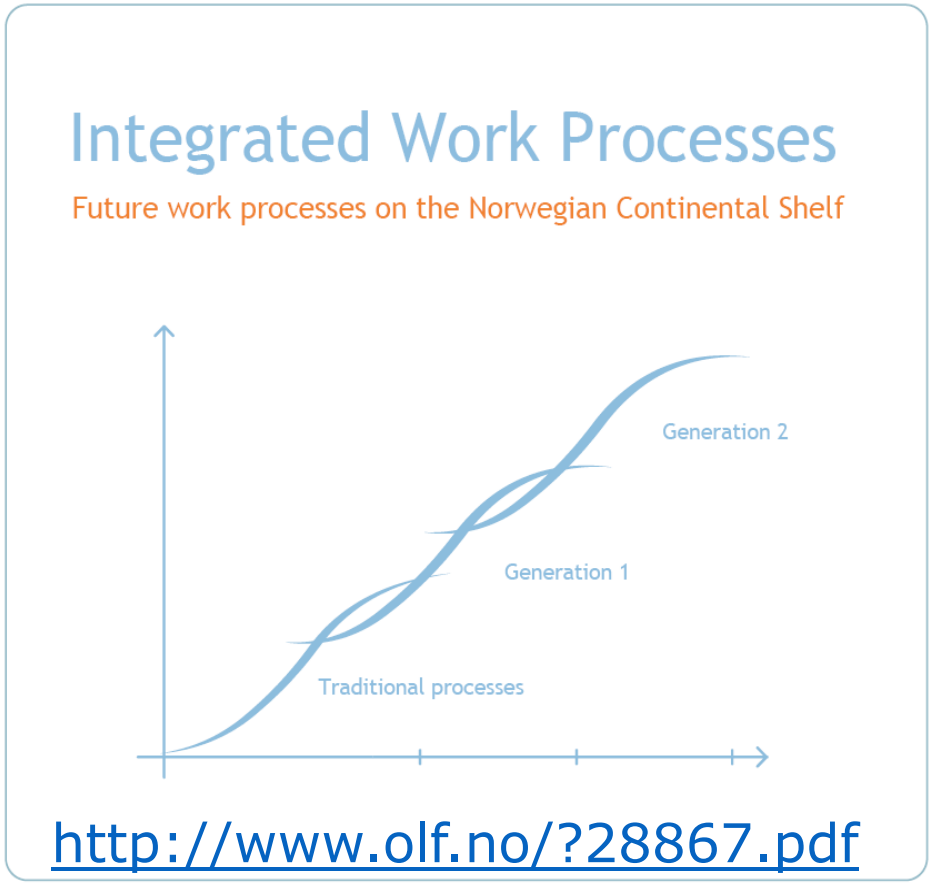
SIGNIFICANT GROWTH POTENTIAL
2.5B bbls remaining reserves
Strong exploration interest

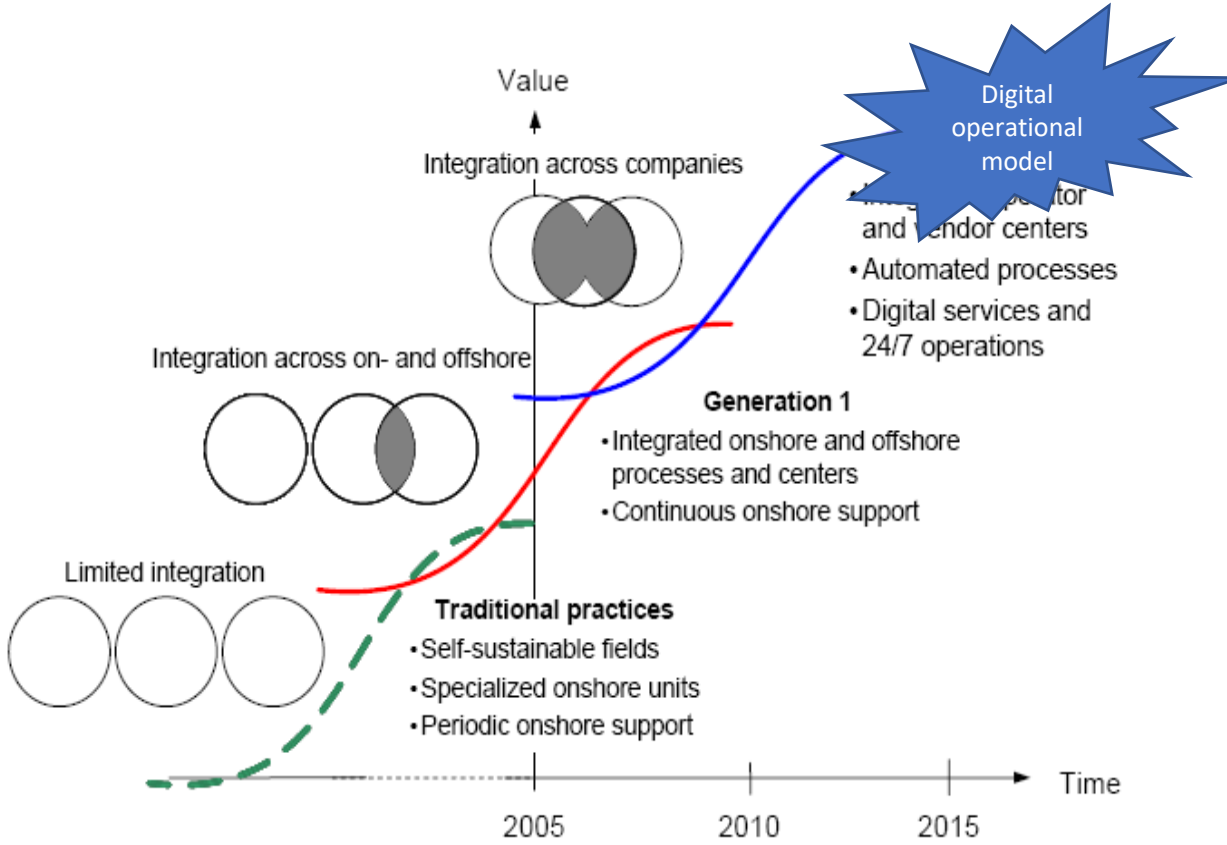
HARSH MARINE ENVIRONMENT
Icebergs and sea ice
Long distances

Safely Adopting Remotely-Controlled and Autonomous Operations in Canada's Offshore

- Canada is modernizing its offshore regulatory regime through the Frontier and Offshore Regulatory Renewal Initiative (FORRI)
- Rapid innovation requires an objective, universally-accepted method to address the risks of new operational situations and verify that new ways of working will be safe and efficient. No such comprehensive method exists in Canada's offshore
- CRIOP-Digital Oceans Operations (CRIOP-DO) aims to:
  - Build upon the Norway's Critical Intervention and Operability Analysis (CRIOP) methodology
  - Focus on human-machine interfaces in normal and abnormal operating scenarios, supporting regulators' confidence in remotely-controlled and autonomous operations
  - Identify research, education and training gaps and foster Canadian-Norwegian collaboration in this space

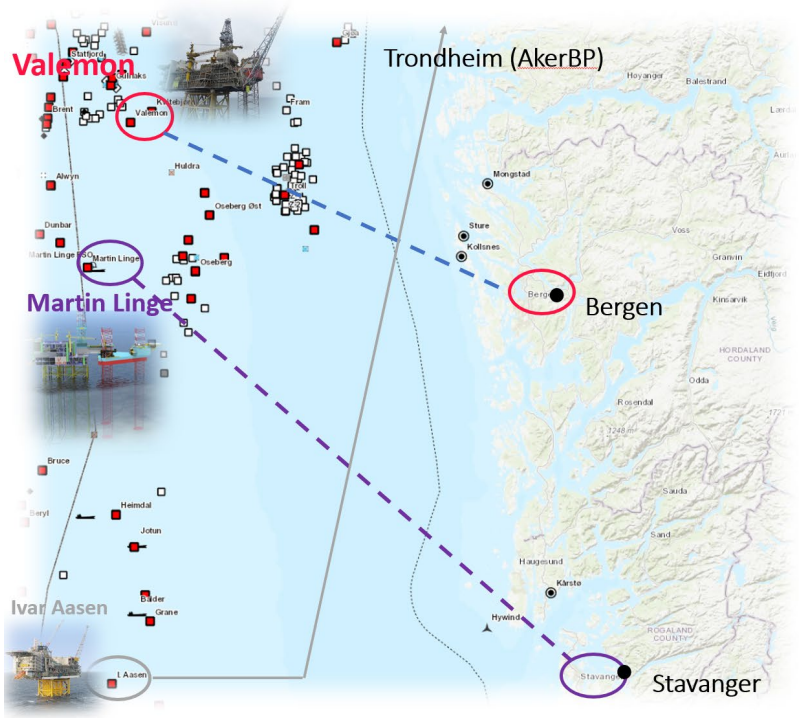
Background: Integrated operations (2004->)





OLF: The Norwegian Oil Industry Association

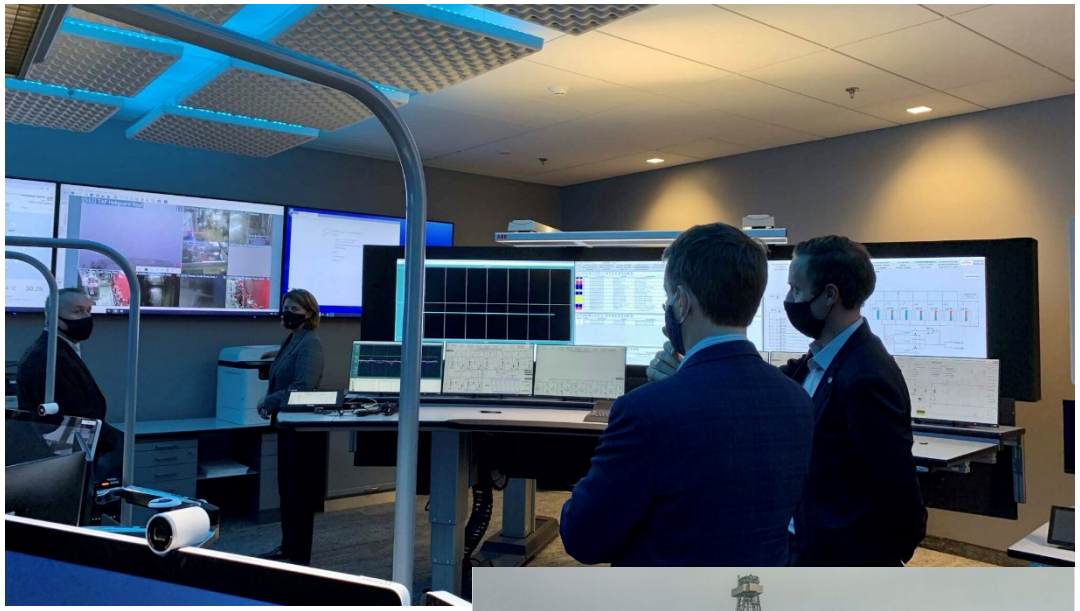
Onshore control rooms are becoming the new standard



Bergen – Sandsli ➔ for Valemon

Trondheim – AkerBP ➔ for Ivar Aasen

Stavanger – Dusavik ➔ Forus – for Martin Linge



ExxonMobil Hebron (onshore control room)

https://twitter.com/SeamusORegan/status/1313125130135011330/photo/1

WHY ARE THE REGULATIONS PERFORMANCE-BASED?

In the early years of Norway's petroleum industry, the regulatory regime was based on specific requirements, checks, inspections and detailed orders.

That represented a marked contrast to today's system, which is characterised by performance management, a systems orientation and dialogue between the government and the companies.

Why the detailed regulations?

Making it clear what the government expected of the companies was important during the early years, when the industry was new and unfamiliar.

One consequence was that supervision often focused on details and components, usually followed by specific *orders* to the companies about what had to be improved.

Why the shift to a performance basis?

This initial system had big weaknesses. From a supervisory perspective, for example, the companies only had to correct the faults discovered by the regulator without addressing the underlying causes of non-conformities or problems.

The industry also found that the detailed requirements restricted opportunities for innovation and technology development.

But the greatest source of concern from the government's viewpoint was that detailed regulation did not help the companies to grasp their own overall responsibility. Nor was the climate of collaboration between regulator and companies good.

The transition from the original reliance on detailed control to the present framework-based approach was gradual. But the regulations were eventually reshaped to express *which* requirements must be met by the companies rather than specifying *how* this is to be done.

PSA Safety regulations (simplified)

PETROLEUM SAFETY AUTHORITY NORWAY

A regulatory regime supporting the development of remote operations

Technology

- Movement from prescriptive to more performance based requirements:
  - SAS/Telecom infrastructure for remote operations
  - IMR Condition based monitoring/predictive maintenance
  - Adjustments of technical standards in light of digitalisation
  - New cyber-security standards

Work processes

- Support verification activities in new work processes enabled by digitalisation
- Verify a digital operating model

Governance

- Drive development of arenas cross-industry work groups where strategic digitalisation topics are addressed with involvement of the major stakeholders through a Regulatory Forum
- Enable standardisation and data sharing in the industry

Competence development/training

- Facilitate the development of new competence requirements in collaboration with stakeholders
- Support research and universities to develop competence in this new field
- Increase internal regulator competence

NRC·CNRC

NRC.CANADA.CA

Human Factors Safety Research at NRC-OCRE

NRC-OCRE Marine Safety Background

- Twenty plus years of Marine Safety research at NRC-OCRE.
- Multi-disciplinary approach (engineering, human factors, modelling, etc.) to addressing research question.
- Holistic answers required; ignoring one or more aspects will likely result in failure.

Human Factors (HF) Research in Harsh Environments

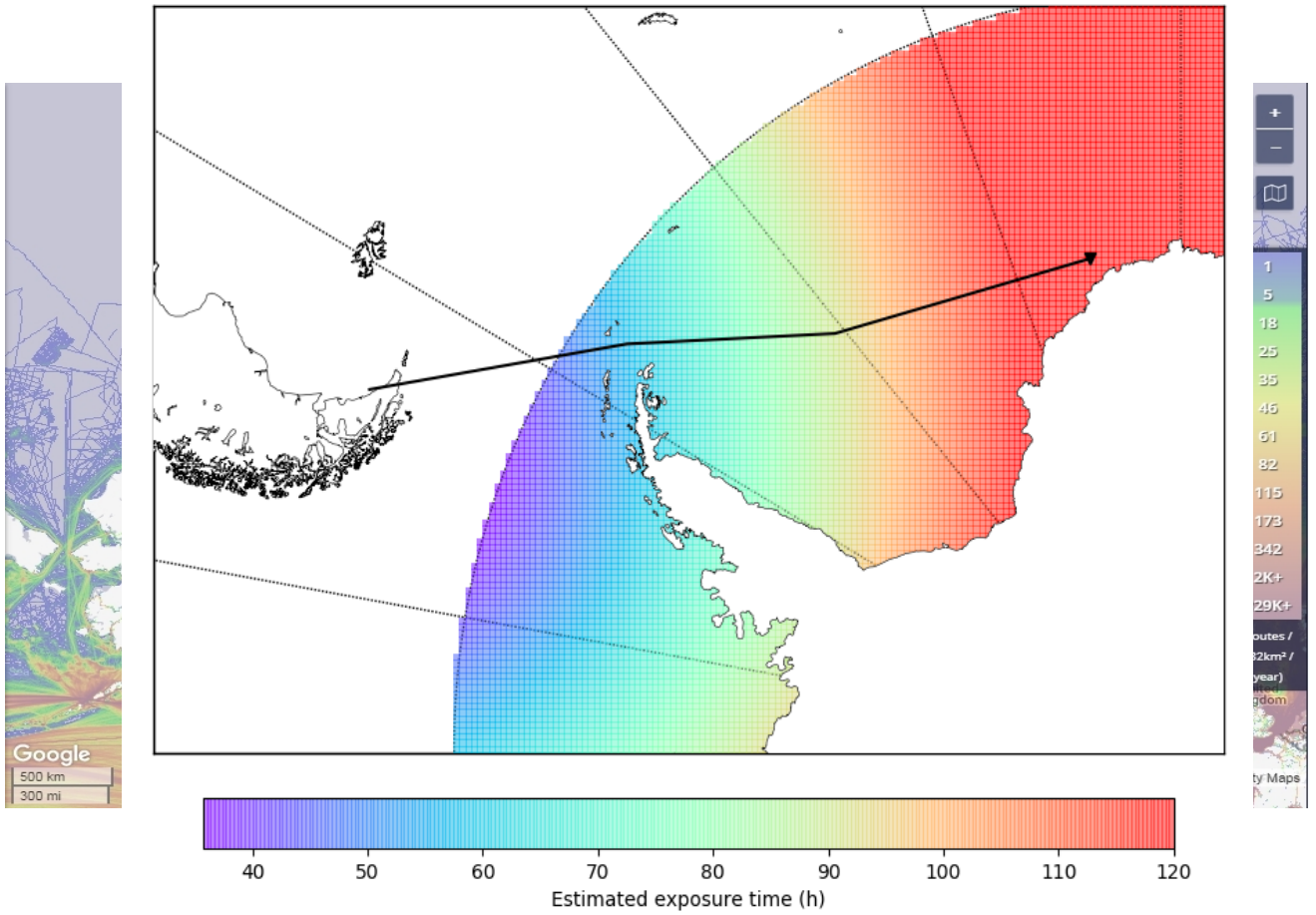
- Performance gaps exist when area of operations not considered.
- NRC-OCRE research attempts to close that gap by testing in representative conditions.
- Results identify deficiencies and help move standards and regulations further.

Survival in Extreme Environments

- In marine accidents, people may have to survive in both cold and hot environments.
- Do Life Saving Appliances (LSA) perform to the level we need them to, for as long as we need them to?
- Some environments are not conducive to survival.

Survival cont.

- Working with Transport Canada (TC) to submit research for IMO SSE sub committee.
- Estimating exposure time and vessel of opportunity impact.
- Working with Memorial University (MU) to investigate effect of rations on thermoregulation while exposed to cold.



Performance in Extreme Environments

- Normal operations can occur in extreme environments.
- Important to understand performance of equipment to ensure it meets *the specific requirements of the situation.*
- NRC-OCRE works with Canadian Armed Forces to quantify performance of potential equipment.

Development of “Smart” Ships

- New area of HF research for NRC-OCRE.
- Collaboration with NRC-AERO and MU to explore methods for knowledge capture of experienced sea farers.
- Pilot project investigated eye tracking in ice management simulators.
- Planned work to determine field viability of eye tracking.

THANK YOU

Jonathan Power, Ph. D. • National Research Council of Canada • jonathan.power@nrc.ca